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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary

Application No.

10/530,002

Applicant(s)

UENSAL ET AL.

Examiner

EUGENIA WANG

Art Unit

1795

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 26 March 2009.
2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 29-46 and 48-59 is/are pending in the application.
4a) Of the above claim(s) _____ is/are withdrawn from consideration.
5) ☐ Claim(s) _____ is/are allowed.
6) ☒ Claim(s) 29-46 and 48-59 is/are rejected.
7) ☐ Claim(s) _____ is/are objected to.
8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☒ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/S508)
Paper No(s)/Mail Date _____
4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date _____
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on March 26, 2009 has been entered.

Response to Amendment

2. In response to the amendment received March 26, 2009:
- a. Claim 59 has been added as per Applicant's request. Claims 29-46 and 48-59 are pending.
 - b. The previous rejection of record is maintained. A secondary reference has been used to render obvious the new limitations of the newly added claim.

Priority

3. Should applicant desire to obtain the benefit of foreign priority under 35 U.S.C. 119(a)-(d) prior to declaration of an interference, a certified English translation of the foreign application(s) must be submitted in reply to this action. 37 CFR 41.154(b) and 41.202(e).

Failure to provide a certified translation may result in no benefit being accorded for the non-English application.

Claim Rejections - 35 USC § 102

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

4. Claims 29-34, 36, 41-43, 48-50, and 52-58 are rejected under 35 U.S.C. 102(b) as being anticipated by WO 02/38650 (Sakaguchi et al.) as evidenced by "Polyphosphoric Acid Assay" (Innophos). (Note: US 2004/0062969 is being relied upon as the English translation of WO 02/38650.)

Regarding claims 29, 54, 56, and 57 Sakaguchi et al. teaches a path for synthesizing a polybenzazole compound having a phosphono group to be used as electrolyte film for a fuel cell. The path begins with selecting a compound out of a first grouping, the listed group including aromatic tetraamines, and a second compound out of a group consisting of aromatic dicarboxylic acid and their derivatives (para 0091). Additionally, the aromatic dicarboxylic acids can have a phosphonic acid group (para 0092, lines 1-4). The polybenzazole compound having the phosphonic acid group can be synthesized with the two aforementioned precursors by dehydration and cycling polymerization with a solvent of polyphosphoric acid (para 0110, lines 1-11). Afterwards the polybenzazole compound having the phosphonic acid group is added to a resin, which is later cast on a glass or Teflon plate (para 206, lines 1-5; para 0207, lines 6-8). (Note: the aforementioned chemicals used in polymer creation are ones listed in step A) of claims 29, 54, and 57, while the glass/Teflon plate provides the support for the mixture, as denoted in step C) or E) of claims 29, 54, and 57). The inventive polymer is then solidified and can be used as a membrane (para 0210). Additionally, the

composition containing the inventive polybenzazole compound having the phosphonic acid group can be used in a fuel cell assembly, where the solid polymer and electrode catalytic layers are bonded to both surfaces thereof as a component of the solid polymer electrolyte membrane/electrode assembly (as applied to claims 54, 56, and 57) (para 0214). Methods of forming the electrolyte membrane/electrode assembly include hot-pressing with a catalytic metal and a binder, spraying the polymer electrolyte with the inventive polybenzazole compound with the sulfonic/phosphonic acid group to a gas-diffusion electrode and then joining the two, hot-pressing a membrane with a prepared pastes with the polymer electrolyte and catalyst, applying the electrolyte paste and drying (as applied to claims 54, 56, 57) (para 0227-0229). Sakaguchi et al.'s membrane/electrode assembly also states an inventive property in which both the solid polymer electrolyte membrane and the electrode catalytic layers are preferably mainly composed of the inventive polybenzazole compound having sulfonic/phosphonic acid group (as applied to claim 57) (para 0217). As to steps B) or D), of claims 29, 54, and 57, Sakaguchi et al. mentions that heat can be applied during the reaction and that the optimum temperature depends on the combination of monomers (para 0113, lines 3-4). Additionally, Sakaguchi et al. talks about a drying atmosphere during a heating phase using air or inert gas (para 210, lines 7-9). In a different heating part of the process, Sakaguchi et al.'s reaction is said to be carried out at a high temperature, and the reaction temperature is preferably lowered in the range capable of attaining the effects of the invention (para 0113, lines 7-10). With respect to step F), the polyphosphoric

acid moieties of the above membrane are expected to inherently partially hydrolyze (and thus would form the same product as claimed).

Where applicant claims a composition in terms of a function, property or characteristic and the composition of the prior art is the same as that of the claim but the function is not explicitly disclosed by the reference, the examiner may make a rejection under both 35 U.S.C. 102 and 103, expressed as a 102/103 rejection.

The fact that a certain result or characteristic may occur or be present in the prior art is not sufficient to establish the inherency of that result or characteristic. In re Rijckaert, 9 F.3d 1531, 1534, 28 USPQ2d 1955, 1957 (Fed. Cir. 1993).

"In relying upon the theory of inherency, the examiner must provide a basis in fact and/or technical reasoning to reasonably support the determination that the allegedly inherent characteristic necessarily flows from the teachings of the applied prior art." Ex parte Levy, 17 USPQ2d 1461, 1464 (Bd. Pat. App. & Inter. 1990)

In the case of the instant application the basis for expectation of inherency is the fact that the conditions of Sakaguchi et al. would provide an environment in which polyphosphoric acid hydrolyzes. Examiner points to Example 1 (para 0254-0260) as well as para 0210 to explain the expectation for inherency. As stated in para 0255, the polymer is immersed in water, and in para 0210, it is stated that solidification can be done in air. In both cases (water immersion and air solidification) humidity is available, and with humidity present, the polyphosphoric acid is expected to hydrolyze. Innophos is used as an evidentiary piece to show this characteristic. In the "Validation" section (p2), it is stated that polyphosphoric acid is highly hygroscopic and rapidly absorbs moisture

even when only exposed to air (therefore exposure to water would result in water being absorbed as well, as applied to Sakaguchi). Furthermore, Innophos states that once the once moisture is absorbed the hydrolysis process beings ("Validation" section on p2). Therefore, since polyphosphoric acid is inherently hygroscopic and starts hydrolyzing upon absorption of water, it is expected that the polphosphoric acid of Sakaguchi et al. would partially hydrolyze.

The Examiner requires applicant to provide that the prior art products do not necessarily or inherently possess the characteristics of his [or her] claimed product.

Whether the rejection is based on inherency' under 35 U.S.C. 102, on prima facie obviousness' under 35 U.S.C. 103, jointly or alternatively, the burden of proof is the same...[footnote omitted]." The burden of proof is similar to that required with respect to product-by-process claims. In re Fitzgerald, 619 F.2d 67, 70, 205 USPQ 594, 596 (CCPA 1980) (quoting In re Best, 562 F.2d 1252, 1255, 195 USPQ 430, 433-34 (CCPA 1977)).

For the reasons above, Sakaguchi et al.'s product is the same as the one in the claimed invention. It is noted that the heating temperature and atmosphere mentioned in step B can be varied, as long as the process still produced the proton-conducting polymer membrane comprising of polyazoles containing phosphonic acid groups as claimed in the preamble.

"[E]ven though product-by-process claims are limited by and defined by the process, determination of patentability is based on the product itself. The patentability of a product does not depend on its method of production. If the product in the product-

by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process." In re Thorpe, 777 F.2d, 698, 227 USPQ 964, 966 (Fed. Cir. 1985)(citations omitted).

"The Patent Office bears a lesser burden of proof in making out a case of prima facie obviousness for product-by-process claims because of their peculiar nature" than when a product is claimed in the conventional fashion. In re Fessmann, 489 F.2d 742, 744, 180 USPQ 324, 326 (CCPA 1974). Once the Examiner provides a rationale tending to show that the claimed product appears to be the same or similar to that of the prior art, although produced by a different process, the burden shifts to applicant to come forward with evidence establishing an unobvious difference between the claimed product and the prior art product. In re Marosi, 710 F.2d 798, 802, 218 USPQ 289, 292 (Fed. Cir. 1983). Ex parte Gray, 10 USPQ2d 1922 (Bd. Pat. App. & Inter. 1989). See MPEP section 2113.

As to claim 30 and 32, the tetraamino compound in the form of formulas (A) and (C), respectively, is not specifically mentioned. Examples given in para 0093 do not make note of the Y_pZ_r portion of formula (A) or the $Y_pZ'_r$ portion of formula (C). However, derivatives can be used as well, and specific examples of the derivatives of the tetraamines that can be used include salts with acids including *phosphoric* and *sulfuric* acid (applied to claims 30 and 32, respectively), which accounts for the Z portion and may include the Y_p portion as well (para 0094, lines 1-4). Additionally, formulas (A) and (C) are intermediates of the final product mentioned in claim 26. The final product would still include the phosphonic acid group. See MPEP section 2113.

As to claims 31 and 34, an example of the aromatic and or/heteroatomic carboxylic acid is 2,5-dicarboxyphenylphosphonic acid (para 0101, lines 8-9). This example shows the claimed form (B) except for the fact that "p" is zero. However, derivatives of the phosphonic acid can be used (para 0101, lines 10). A carbon chain, as represented by Y_p , added to the phosphonic acid group would be a derivative of the aforementioned phosphonic acid group. Additionally, this formula (B) is an intermediate of the final product mentioned in claim 29. Z_r is still present in Sakaguchi et al.'s teaching and would be used to form the polymer with the phosphonic acid group. See MPEP section 2113. Additionally the aromatic and/or heteroaromatic tetraaminos given for examples do not have a phosphonic acid group, as can be seen by one compound given as an example: 1,2,4,6-tetraaminobenzene (as applied to claim 34)

As to claim 33 an example of the aromatic and or/heteroatomic carboxylic acid is 2,5-dicarboxyphenylphosphonic acid (para 0101, lines 8-9). The differences between this example and form (D) are (1) "p" is zero and (2) Z_r is a phospho group rather than a sulfo group. However, Sakaguchi et al. also mention that dicarboxylic acid having sulfonic acid group and phosphonic acid group may be copolymerized to synthesize the polybenzazole having sulfonic acid group and/or phosphonic acid group, which could represent the Y_pZ_r portion of (D) (para 0108). Therefore, Sakaguchi et al.'s aromatic carboxylic acid serves the same purpose as claim 33, which can be applied to the final product mentioned in claim 29. See MPEP section 2113.

Regarding claim 36, Sakaguchi et al. teach a membrane that uses of compounds such as terephthalic acid and 2,2-bis(4-carboxyphenyl-)hexafluoropropane for use of copolymerization for synthesizing polybenzazole (para 0105, lines 1-7, 12, and 15-16).

As to claims 41, 42, and 43, Sakaguchi et al. teaches the use of dicarboxylic acids and Gerber teaches the use of tri and tetra carboxylic acids in the formation of polyazoles. Although specific percentages used for the reaction are not claimed, a certain amount polycarboxylic acid is needed for the reaction to provide the final product. See MPEP section 2113.

As to claim 48, Sakaguchi et al. teaches an inventive resin molding containing the polybenzazole compound having the phosphonic acid group (para 0195). Additionally, the solid polymer electrolyte membrane prepared by mixing a polymer other than the inventive polybenzazole compound having the phosphonic/sulfonic acid group may be employed as the polymer electrolyte membrane (para 0221, lines 1-6). An example of a sulfonated polybenzoxazole compound being mixed with another polymer is shown in example 14, when the compound was later mixed with carbon black, which contains platinum and nafion (para 0305).

As to claim 49, Sakaguchi et al.'s process includes a heating portion after the inventive solution of polybenzazole with the sulfonic acid group is cast on the Teflon or glass plate (para 0210). Such a portion is done with water in the presence of air (both water and air have moisture) (para 0210). The heating portion for drying the sheet is adjustable (para 210, lines 3-2). Although no temperature is specifically given, the end

product is the same, and the temperature is adjustable in order to optimize solvent removal and homogeneity of the composite. See MPEP section 2113.

Regarding claim 50, the treatment to get the membrane to be self supporting includes drying out the solvent. Although no specific time period is given by Sakaguchi et al., the speed is adjusted by adjusting the temperature to optimize homogeneity (para 0210). Additionally, thickness would also effect the time. Discovery of optimum of result effective variable in known process is ordinarily within the skill of art. (In re Boesch, 205 USPQ 215 (CCPA 1980).) Selection of optimum ranges within the prior art's general condition is obvious. (In re Aller, 105 USPQ 233(CCPA 1955))

As to claims 52, 53, and 55, thickness ranges are given at different parts of Sakaguchi et al.'s process. The ranges given for the membrane after the cast is laid is between 10 μm and 1000 μm , preferably between 100 μm and 500 μm , which lies between the range claimed in 52 (para 208). After the membrane is dried, as in step D, the thickness suggested should optimize ion conductivity and mechanical strength. A thickness mentioned that is preferable to both variables is 20 μm (as applied to claim 53) (paras 0211, 0212). The thickness range for the solid polymer electrolyte membrane/electrode assembly, as applied to claim 55, is between 5 μm and 300 μm , preferably between 10 μm and 100 μm (para 0223).

Regarding claims 58, Sakaguchi et al. teach the use of the polymeric material in a solid polymer electrolyte membrane, which is preferably employed in fuel cells (para 0317, lines 1-7).

Response to Arguments

5. Applicant's arguments filed March 26, 2009 have been fully considered but they are not persuasive.

Applicant argues that since the Sakaguchi et al. teach of removing not partial hydrolysis of polyphosphoric acid moieties, wherein Applicant specifically points to para 0255 of Sakaguchi et al., which states that the polymer obtained was rinsed until the pH was neutralized to show that polyphosphoric acid was completely removed from the polymer.

Examiner respectfully disagrees. Although Sakaguchi et al. teach of rinsing the polymerized material until the pH is neutral, this is not an indication that no polyphosphoric acid remains in the polymer. The rinsing only rids Sakaguchi et al.'s membrane of excess polyphosphoric acid. However, the polyphosphoric acid used within the polymerization would stay in the polymerized product (i.e. some of the polyphosphoric acid would remain in the polymerized product), which is where Examiner's position lies. Accordingly (as evidenced by Innophos) the polyphosphoric acid within the product of the polymerization would inherently partially hydrolyze. Applicant has not shown any proof as to how none of the polyphosphoric acid within the polymerization solution of Sakaguchi et al. is not within the polymerized product. Thus, Applicant has not shown that the claimed product is different than that of Sakaguchi et al. Accordingly, Examiner maintains the position that the polymeric membrane does have some polyphosphoric acid (wherein only the excess that is not used in polymerization is rinsed off) that inherently hydrolyzes when in contact with water.

Applicant argues that after repeatedly rinsing until the pH is neutralized, that the polymer of Sakaguchi is likely to contain no (detectable) polyphosphoric acid.

Examiner respectfully disagrees with Applicant's position. Specifically, Examiner points out that applicant states that it is "likely" that no "detectable" amount of polyphosphoric acid would remain. However, such statements are open-ended and do not provide certainty that none of the polyphosphoric acid would remain in the polymer. not show clear proof as to how that none of the partially hydrolyzed polyphosphoric acid is remaining in the polymer of Sakaguchi et al. Thus, Applicant has not shown that the claimed product is different than that of Sakaguchi et al. Accordingly, Examiner maintains the position that the polymeric membrane does have some polyphosphoric acid (wherein only the excess that is not used in polymerization is rinsed off) that inherently hydrolyzes when in contact with water.

Applicant submits that the Exhibits with respect to the Material Safety Data Sheets (MSDS) for polyphosphoric acid shows that it is completely soluble in water with the formation of orthophosphoric acid and thus the repeated rinsing would remove polyphosphoric acid within the limit of detection.

Examiner respectfully disagrees. Although polyphosphoric may be miscible (as stated in section 9 of the MSDS), it only means that water and polyphosphoric acid are mixable. It does not preclude the fact that it would react (via hydrolysis) in water. Specifically, section 10 is pointed to, wherein like Innophos, the MSDS is stated to be reactive with moisture and hygroscopic. Accordingly, the MSDS, as provided by Applicant supports Examiner's position that in the presence of water, it would be

reactive. Accordingly, there is no convincing proof or showing that none of the hydrolyzed product would remain in the membrane. It is noted that the arguments with respect to the orthophosphoric acid are irrelevant. Although orthophosphoric acid may be formed, such a product is the fully hydrolyzed product of polyphosphoric acid, which does not form under the condition of Sakaguchi et al. Innophos is relied upon to show the conditions to form orthophosphoric acid – specifically that the rate in cooler temperatures is slow and that boiling in water for 30 minutes to an hour or more (first paragraph in Validation section) is required. Sakaguchi et al.'s introduction to water is not done in such conditions, as it is said to have cooled and rinsed, which is different than being boiled for a long period of time (para 0255). Applicant has not shown any proof as to how none of the polyphosphoric acid within the polymerization solution of Sakaguchi et al. is not within the polymerized product. Thus, Applicant has not shown that the claimed product is different than that of Sakaguchi et al. Thus, the rejection of record is maintained.

Applicant submits the MSDS for orthophosphoric acid and argues that it is miscible in water in all proportions, and thus as soon as this hydrolyzed product is formed, it would be immediately removed by water.

Examiner respectfully disagrees with Applicant's position, and submits that the arguments with respect to orthophosphoric acid are irrelevant. Innophos is relied upon to show the conditions to form orthophosphoric acid – specifically that the rate in cooler temperatures is slow and that boiling in water for 30 minutes to an hour or more (first paragraph in Validation section) is required. Sakaguchi et al.'s introduction to water is

not done in such conditions, as it is said to have cooled and rinsed, which is different than being boiled for a long period of time (para 0255). Accordingly, such an argument is irrelevant and not convincing, and the rejection of record is maintained.

Applicant argues that due to the reasoning above that the process employed will result in the complete removal of polyphosphoric acid and the products of its hydrolysis. However, Applicant goes on to state that it is possible that individual molecules of the acid or the hydrolyzed form may remain that the product is expected to be below the limit of detection.

Examiner respectfully disagrees. As set forth in the above responses, Applicant has not shown convincing proof of the complete removal of polyphosphoric acid and its products of hydrolysis. Furthermore, it is submitted that Applicant admits that there may be polyphosphoric acids and products of its hydrolysis included within the polymer. Examiner would like to note that the inclusion of any such molecules (even at low or undetectable amounts) would still read on the claim language (or claims 29, 54, and 57), as nothing in the claim language requires a certain amount to be present or precludes the presence in a small amount. Office personnel are to give claims their broadest reasonable interpretation in light of the supporting disclosure. *In re Morris*, 127 F.3d 1048, 1054-55, 44 USPQ2d 1023, 1027-28 (Fed. Cir. 1997). Also, limitations appearing in the specification but not recited in the claim are not read into the claim. See *In re Zletz*, 893F.2d 319, 321-22, 13 USPQ2d, 1320, 1322 (Fed. Cir. 1989).

Applicant argues that the Examiner's position is legally untenable, as the inquiry of product by process claims is whether there are material differences between

Applicant's product and those of Sakaguchi et al., wherein such low undetectable amounts would not bridge the gap in physical properties of Applicant's product.

Examiner respectfully disagrees and submits that the comparison is between Applicant's *claimed invention* and the product of the prior art. As set forth above, Applicant has not established any material difference between the product and the claimed invention (wherein, as set forth in the rejection, it would be inherent that at least a portion of a hydrolyzed polyphosphoric acid would remain in the product). In response to applicant's argument that the references fail to show certain features of applicant's invention, it is noted that the features upon which applicant relies (i.e., that more than a low amount of the ingredient exists) are not recited in the rejected claim(s). Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993). Accordingly, Examiner submits that Applicant has not defined the physical structure of the claimed invention over the prior art. Thus, the rejection of record is maintained.

Applicant argues that Exhibits A and B as well as para 0254-0260 of Sakaguchi et al.'s product would only have low amounts (below detection) of polyphosphoric acid and orthophosphoric acid, whereas Applicant's teach of a *partial* hydrolysis of polyphosphoric acid.

Examiner respectfully disagrees. Exhibits A only shows that polyphosphoric acid's final hydrolyzed product is orthophosphoric acid. It is submitted (a) that such a fully hydrolyzed from of polyphosphoric acid (orthophosphoric acid) would not exist and

(b) that the *partial* hydrolysis of polyphosphoric acid would take place (to yield the same product as claimed by the instant application). With respect to (a), Innophos is relied upon to show the conditions to form orthophosphoric acid – specifically that the rate in cooler temperatures is slow and that boiling in water for 30 minutes to an hour or more (first paragraph in Validation section) is required. Sakaguchi et al.'s introduction to water is not done in such conditions, as it is said to have cooled and rinsed, which is different than being boiled for a long period of time (para 0255). With respect to (b), it is noted that the reasons for inherency have been set forth within the rejection but is reiterated herein for clarity's sake. In the case of the instant application the basis for expectation of inherency is the fact that the conditions of Sakaguchi et al. would provide an environment in which polyphosphoric acid hydrolyzes. Examiner points to Example 1 (para 0254-0260) as well as para 0210 to explain the expectation for inherency. As stated in para 0255, the polymer is immersed in water, and in para 0210, it is stated that solidification can be done in air. In both cases (water immersion and air solidification) humidity is available, and with humidity present, the polyphosphoric acid is expected to hydrolyze. Innophos is used as an evidentiary piece to show this characteristic. In the "Validation" section (p2), it is stated that polyphosphoric acid is highly hygroscopic and rapidly absorbs moisture even when only exposed to air (therefore exposure to water would result in water being absorbed as well, as applied to Sakaguchi). Furthermore, Innophos states that once the moisture is absorbed the hydrolysis process begins ("Validation" section on p2). Therefore, since polyphosphoric acid is inherently hygroscopic and starts hydrolyzing upon absorption of water, it is expected that the

polyphosphoric acid of Sakaguchi et al. would partially hydrolyze (as full hydrolysis would require being boiled in water for a long period of time, as set forth within the response to portion "(a)", thus yielding the expectation of a partially hydrolyzed product).

Applicant argues that partial hydrolysis of polyphosphoric acid leads to strengthening the membrane, decreasing the thickness in the layer, permits controlling of the conductivity of the membrane and thus differs with the product of Sakaguchi (which completely removes polyphosphoric acid and its hydrolysis products).

Examiner respectfully disagrees. First it is noted that Applicant has not shown/provided convincing evidence that all polyphosphoric acid and its hydrolysis products are removed, as set forth above. Secondly, it is noted that even if the amount of polyphosphoric acid and its hydrolysis products is small, it still reads on the claim language, as nothing in the independent claims 29, 54, and 57 differentiates the claimed product with that a product having a small amount of polyphosphoric acid and its hydrolysis products. In response to applicant's argument that the references fail to show certain features of applicant's invention, it is noted that the features upon which applicant relies (i.e., the fact that partial hydrolysis of polyphosphoric acid leads to strengthening the membrane, decreasing the thickness in the layer, permits controlling of the conductivity of the membrane) are not recited in the rejected claim(s). Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993). Accordingly, it is submitted that the claimed product and the product of

Sakaguchi et al. has not been made structurally distinct. Thus the rejection of record is maintained.

Applicant argues that Sakaguchi et al. teaches away from raising the concentration of phosphoric acid above the limit of detection as Sakaguchi et al. teaches that phosphoric and sulfonic acid groups are used for conductivity and thus the presence of additional ionic conductors would be undesirable.

Examiner respectfully disagrees. First it is noted that, just because Sakaguchi et al. uses sulfonic and phosphoric acid groups for conductivity does not necessarily constitute a teaching away. In fact, Sakaguchi et al.'s general teaching is to the fact that improved conductivity is desirable. Although Sakaguchi et al. teaches of one embodiment of something that improves conductivity, it does not preclude the inclusion of other materials that can improve the same characteristic. Accordingly, it would be obvious to one of ordinary skill in the art to want to improve conductivity within an electrochemical cell in order to produce more power (rather than to purposely decrease producing capability of the cell, as Applicant is suggesting). Furthermore, it is noted that such an argument is irrelevant to an anticipatory rejection, as the structure is the same.

With respect to claim 59, Applicant argues that Sakaguchi et al. does not teach of the concentration of phosphoric acid in the final membrane (10 to 80 moles per mol of repeating unit of polyazole polymer)

Examiner submits that the aforementioned claim has been rendered obvious using a new secondary reference, as set forth within the 103 section.

Applicant argues that the process of Sakaguchi et al. is different from the process of the instant base claims, wherein the products differ due to these different processes (specifically that Sakaguchi et al.'s polyphosphoric acid is removed, wherein that of the instant application's is not and is retained in a partially hydrolyzed form).

Examiner respectfully disagrees. As set forth within the response above and within the rejection, Applicant has not shown any convincing evidence or proof that *all* of the polyphosphoric acid and its hydrolyzed version is removed in Sakaguchi et al. Specifically, it is noted that Examiner sets forth (within the rejection and above) how the product of Sakaguchi et al. would inherently retain a portion of hydrolyzed polyphosphoric acid, wherein Applicant even admits that small amounts (undetectable) may still exist within the polymer structure. Accordingly, it is submitted that such a structure still reads on independent claims 29, 54, and 57, as nothing in the claim differentiates the structure of the claimed invention from that of Sakaguchi et al. Accordingly, the rejection of record is upheld.

Claim Rejections - 35 USC § 103

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

6. Claim 35 is rejected under 35 U.S.C. 103(a) as being unpatentable over Sakaguchi et al. evidenced by Innophos, as applied to claim 29, in view of 2001/0003130 (Matsuoka et al.).

The difference between the teachings of Sakaguchi et al. and claim 35 is that none of the compounds 3,3',4,4'-tetraaminobiphenyl, 2,3,5,6-tetraaminopyridine, and/or 1,2,4,5-tetraaminobenzene are taught as being used as a polymeric precursor.

Matsuoka et al. teaches the preparation of polybenzazole and a polybenzazole fiber, which uses 1,2,4,5-tetraaminobenzene as a used to make the polybenzazole polymer (para 0013; para 0015, line 4). Sakaguchi et al. discloses the claimed invention except for using 1,2,5,5-tetraaminobenzene as a polymeric precursor.

It would have been obvious to one having ordinary skill in the art at the time the invention was made to use this polymeric precursor, since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. *In re Leshin*, 125 USPQ 416.

7. Claims 37 and 38 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sakaguchi et al. evidenced by Innophos, as applied to claim 29, in view of JP 2002-146016 (Nakao et al.).

As to claim 37, the difference between Sakaguchi et al. and claim 37 is that Sakaguchi et al. does not mention the use of 2,3-diamino-5-carboxyphenylphosphonic acid, 2,3-diamino-6-carboxyphenylphosphonic acid, or 3,4-diamino-6-carboxyphenylphosphonic acid.

Nakao et al. teach an ion-conductive polyazole electrolyte with a phosphonic acid group, wherein carboxyphenylphosphonic acids are precursors used (para 0013). Furthermore, it is embodied that the carboxylic acids may have a two amino groups on it

(diamino) (para 0014). Therefore, Nakao teaches the use of diamino-carboxyphenylphosphonic acids thus obviating the use of all diamino-carboxyphenylphosphonic acids (including the ones specifically embodied, barring evidence showing criticality of the claimed diamino-carboxyphenylphosphonic acids over all others). It would have been obvious to one having ordinary skill in the art at the time the invention was made to use a diamino-carboxyphenylphosphonic acid as claimed, since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. *In re Leshin*, 125 USPQ 416.

As to claim 38, the difference between Sakaguchi et al. and claim 38 is that Sakaguchi et al. does not mention the use of 2,3-diamino-5-carboxyphenylsulfonic acid, 2,3-diamino-6-carboxyphenylsulfonic acid, or 3,4-diamino-6-carboxyphenylsulfonic acid.

As noted in the rejection of claim 37, Nakao et al. teach an ion-conductive polyazole electrolyte with a phosphonic acid group, wherein diamino-carboxyphenylphosphonic acids are used (para 0013-0014). Since Nakao et al. teach the use of diamino-carboxyphenylphosphonic acids, Nakao et al. obviates the use of all diamino-carboxyphenylphosphonic acids.

However, it is noted that Sakaguchi et al. teach that Sakaguchi et al. teach a polybenzazole with sulfonic acid or phosphonic acid groups, wherein both exhibit excellent processability, durability, solvent resistance, mechanical properties, and ion conductivity that satisfy the object of creating a polymer membrane (para 0022). Therefore, in this case Sakaguchi et al. teach that that phosphonic and sulfonic acid

groups have similar properties and achieve the same goals and are thus art recognized equivalents. Therefore, Nakao et al.'s teaching of a diamino-carboxyphenylphosphonic acid obviates all diamino-carboxyphenylsulfonic acids (including the ones specifically embodied, barring evidence showing criticality of the claimed diamino-carboxyphenylsulfonic acids over all others), as it would have been obvious to one of ordinary skill in the art to substitute art equivalents for one another (diamino-carboxyphenylphosphonic acid and diamino-carboxyphenylsulfonic acids). Accordingly, it would have been obvious to one having ordinary skill in the art at the time the invention was made to use a diamino-carboxyphenylsulfonic acid (including the ones specifically embodied, barring evidence showing criticality of the claimed diamino-carboxyphenylphosphonic acids over all others) precursor, since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. *In re Leshin*, 125 USPQ 416.

8. Claims 39, 40, 44, and 45 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sakaguchi et al. evidenced by Innophos, as applied to claim 29, in view of US Patent 3783137 (Gerber).

As to claim 39, the difference between the teachings of Sakaguchi et al. and claim 39 is that the polymeric precursors do not mention the use of aromatic tricarboxylic acids, their C1-C20-alkyl esters or C5-C12-aryl esters or their acid anhydrides or their acid halides or tetracarboxylic acids, their C1-C20-alkyl esters or C5-C12-aryl esters or their acid anhydrides or their acid halides.

Gerber teaches a method of producing heterocyclic polymers. This type of polymer includes polybenzimidazole-type compositions (col 2, lines 61-63). It teaches the use of the prepolymer 1,4,5,8-naphthalenetetracarboxylic acid dianhydride, which is an example of a tetracarboxylic 1acid anhydride as specified by claim 39 (col 13, lines 55-56).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to use this polymeric precursor, since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. *In re Leshin*, 125 USPQ 416.

As to claim 40, the difference between the teachings of Sakaguchi et al. and claim 40 is that the polymeric precursors do not mention the use of 1,3,5-benzenetricarboxylic acid (trimesic acid), 2,4,5-benzenetricarboxylic acid (trimellitic acid), (2-carboxyphenyl)imondiacytic acid, 3,5,3'-biphenyltricarboxylic acid, 2,5,4'-biphenyltricarboxylic acid, 2,4,6-pyridinetricarboxylic acid, benzene-1,2,4,5-tetracarboxylic acid, (naphthalene-1,4,5,8-tetracarboxylic acid, 3,5,3',5'-biphenyltetracarboxylic acid, benzophenonetetracarboxylic acid, 3,3',4,4'-biphenyltetracarboxylic acid, 2,2',3,3'-biphenycarboxylic acid and/or 1,2,5,6-naphthalenetetracarboxylic acid.

Gerber teaches a method of producing heterocyclic polymers. This type of polymer includes polybenzimidazole-type compositions (col 2, lines 61-63). Gerber also teaches that mixtures of tricarboxylic acids may be used as acid derivatives, or mixtures

of the acids halides and acid anhydrides may be used in the process of the invention (col 5, lines 60-63). In example 4 of the invention, a heterocyclic prepolymer can be formed using trimellitic (2,4,5-benzenetricarboxylic) anhydride monoacid chloride, which falls under the category as an anhydride derivative of the tricarboxylic acid (col 11, lines 35-37).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to use this polymeric precursor, since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. *In re Leshin*, 125 USPQ 416.

As to claims 44 and 45, the difference between the teachings of Sakaguchi et al. and claims 44 and 45 is that the polymeric precursors do not mention the use of heteroatomic dicarboxylic acids, tricarboxylic acids, and/or tetracarboxylic acids containing at least one nitrogen, oxygen, sulfur, or phosphorous atom in the aromatic, namely pyridine-2,5-dicarboxylic acid, pyridine-3,5-dicarboxylic acid, pyridine-2,6-dicarboxylic acid, pyridine-2,4-dicarboxylic acid, 4-phenyl-2,5-pyridinedicarboxylic acid, 3,5-pyrazoledicarboxylic acid, 2,6-pyrimidinedicarboxylic acid, 2,5-pyrazinedicarboxylic acid, 2,4,6-pyridinetricarboxylic acid, benzimidazole-5,6-dicarboxylic acid or their C1-C20-alkyl esters or C5-C12-aryl esters or their acid anhydrides or their acid chlorides.

Gerber teaches the use of diacid halides as a reactant to produced polybenzimidazoles (col 5, lines 15-15). It teaches the use of diacid hydrides derived from 3,5-pyridinedicarboxylic acid and 2,5-pyrazineinedicarboxylic acid.

It would have been obvious to one having ordinary skill in the art at the time the invention was made to use the aforementioned acids, since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. *In re Leshin*, 125 USPQ 416.

9. Claim 46 is rejected under 35 U.S.C. 103(a) as being unpatentable over Sakaguchi et al. evidenced by Innophos, as applied to claim 29, in view of US 6124060 (Akita et al.).

As to claim 46, Sakaguchi et al. does not teach the use of diaminobenzoic acids or its monohydrochloride and dihydrochloride salts as a polymeric precursor.

Akita et al. teach the use of 3,4-diaminobenzoic acid as a precursor for a polybenzimidazole (col. 4, lines 15-32).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to use the aforementioned acids, since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. *In re Leshin*, 125 USPQ 416.

10. Claim 51 is rejected under 35 U.S.C. 103(a) as being unpatentable over Sakaguchi et al. evidenced by Innophos, as applied to claim 29, in view of WO 01/87992 (Kerres et al.). (Note: US 6,767,585 is being used as an intermediate translation of WO01/87992.)

As to claim 51, Sakaguchi et al. does not teach crosslinking of the polymer. Kerres et al. teaches the use of crosslinked polymers including polyzaoles (polybenzimidazole and polycarbazoles) (col 1, lines 10-11 and 40-41). These polymers membranes additionally may include basic groups, such as sulfonic acid groups and are further used in fuel cells (col 1, line 44-45). Although an oxygen-containing atmosphere for the stated crosslinking is not given, crosslinking is a product-by-process.

The motivation for crosslinking is to provide better mechanical stability, improved modulus of elasticity, higher tensile strength, improved swelling properties in order to be used in fuel cells that can run upward 100°C (column 2, lines 30-38). Therefore it would have been obvious to one having ordinary skill in the art at the time the claimed invention was made to modify the teachings of Sakaguchi et al. in order to include a crosslinking step to the process since the result would be in strengthening the membrane's mechanical stability, elasticity, tensile strength, and swell properties.

11. Claim 59 rejected under 35 U.S.C. 103(a) as being unpatentable over Sakaguchi et al. as evidenced by Innophos in view of WO 2004/024797 (Kiefer et al.). It is noted that the US pre-grant publication US 2005/0256296 is being relied upon as a translation for the corresponding WO document, as both are based off of the same PCT application.

Regarding claim 59, Sakaguchi et al. teaches a path for synthesizing a polybenzazole compound having a phosphono group to be used as electrolyte film for a fuel cell. The path begins with selecting a compound out of a first grouping, the listed

group including aromatic tetraamines, and a second compound out of a group consisting of aromatic dicarboxylic acid and their derivatives (para 0091). Additionally, the aromatic dicarboxylic acids can have a phosphonic acid group (para 0092, lines 1-4). The polybenzazole compound having the phosphonic acid group can be synthesized with the two aforementioned precursors by dehydration and cycling polymerization with a solvent of polyphosphoric acid (para 0110, lines 1-11). Afterwards the polybenzazole compound having the phosphonic acid group is added to a resin, which is later cast on a glass or Teflon plate (para 206, lines 1-5; para 0207, lines 6-8). (Note: the aforementioned chemicals used in polymer creation are ones listed in step A) of claims 29, 54, and 57, while the glass/Teflon plate provides the support for the mixture, as denoted in step C) or E) of claims 29, 54, and 57). The inventive polymer is then solidified and can be used as a membrane (para 0210). Additionally, the composition containing the inventive polybenzazole compound having the phosphonic acid group can be used in a fuel cell assembly, where the solid polymer and electrode catalytic layers are bonded to both surfaces thereof as a component of the solid polymer electrolyte membrane/electrode assembly (as applied to claims 54, 56, and 57) (para 0214). Methods of forming the electrolyte membrane/electrode assembly include hot-pressing with a catalytic metal and a binder, spraying the polymer electrolyte with the inventive polybenzazole compound with the sulfonic/phosphonic acid group to a gas-diffusion electrode and then joining the two, hot-pressing a membrane with a prepared pastes with the polymer electrolyte and catalyst, applying the electrolyte paste and drying (as applied to claims 54, 56, 57) (para 0227-0229). Sakaguchi et al.'s

membrane/electrode assembly also states an inventive property in which both the solid polymer electrolyte membrane and the electrode catalytic layers are preferably mainly composed of the inventive polybenzazole compound having sulfonic/phosphonic acid group (as applied to claim 57) (para 0217). As to steps B) or D), of claims 29, 54, and 57, Sakaguchi et al. mentions that heat can be applied during the reaction and that the optimum temperature depends on the combination of monomers (para 0113, lines 3-4). Additionally, Sakaguchi et al. talks about a drying atmosphere during a heating phase using air or inert gas (para 210, lines 7-9). In a different heating part of the process, Sakaguchi et al.'s reaction is said to be carried out at a high temperature, and the reaction temperature is preferably lowered in the range capable of attaining the effects of the invention (para 0113, lines 7-10). With respect to step F), the polyphosphoric acid moieties of the above membrane are expected to inherently partially hydrolyze.

However, it is noted that Sakaguchi et al. does not (a) specifically recognize partially hydrolyzing the polyphosphoric acid moieties, wherein (b) the resultant membrane is 10 to 80 mols of phosphoric acid per mol of repeating unit of polyazole polymer.

With respect to (a), Kiefer et al. teach of a similar polyazole polymer made in a similar fashion (see para 0006-0012). Specifically, it is noted that the presence of the product of partially hydrolyzed of polyphosphoric acid strengthens the fibers [or polyazole material] as well as decreases the thickness of the fiber (para 0115-0116). Therefore the motivation for partially hydrolyzing the polyazole polymer of Sakaguchi et al., as taught by Kiefer et al. would be to impart desired mechanical strength as well as

to decrease the size of the polymer. Therefore it would have been obvious to one having ordinary skill in the art at the time the claimed invention was made to purposely partially hydrolyze the polyphosphoric acid in the polymer of Sakaguchi et al. in order to impart desired strength and slinness of the resultant polymer.

With respect to (b), it is noted that Kiefer et al. render obvious partially hydrolyzing polyphosphoric acid so that it is present in a polyazole polymer (as set forth above with respect to section (a)). Although the concentration of partially hydrolyzed polyphosphoric acid is not specifically embodied, such an amount is seen as a result effective variable, as the amount included would impart a certain degree of strength as well as slinness. It would have been obvious to one having ordinary skill in the art at the time the invention was made to optimize the amount of partially hydrolyzed polyphosphoric acid moities within a polyazole polymer (i.e. to that of 10 to 80 mols per mol of repeating unit of polyazyole polymer) in order to obtained a desired/optimal thickness amount of mechanical strength imparted to the polyazoze polymer, since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. *In re Boesch*, 617 F.2d 272, 205 USPQ 215 (CCPA 1980). It has been held that discovering that general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. *In re Aller*, 105 USPQ 233. Generally, differences in ranges will not support the patentability of subject matter encompassed by the prior art *unless* there is evidence indicating such ranges is critical. *In re Boesch*, 617 F.2d 272, 205 USPQ 215 (CCPA

1980). *In re Aller*, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955). *In re Hoeschele*, 406 F.2d 1403, 160 USPQ 809 (CCPA 1969).

Response to Arguments

12. Applicant's arguments filed March 26, 2009 have been fully considered but they are not persuasive.

With respect to the arguments regarding the 103 rejections, Applicant argues that the prior art used to render obvious the rejected claims (Matsuoka et al., Gerber et al., and Kerres al.) do not cure the deficiencies of the primary reference (Sakaguchi et al.). Applicant does not argue how the combination is not proper. Therefore, the Examiner maintains the obviousness rejections and upholds the rejection of the primary reference, as above.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to EUGENIA WANG whose telephone number is (571)272-4942. The examiner can normally be reached on 7 - 4:30 Mon. - Thurs., EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Patrick Ryan can be reached on 571-272-1292. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/E. W./
Examiner, Art Unit 1795

/PATRICK RYAN/
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